

## **WE CLAIM:**

1. A buck regulator switching power supply, comprising  
  
a switching power supply circuit having an input and an output, a high  
side FET and a low side device, a bootstrap capacitor coupled to the high side  
5 FET;  
  
further comprising a controller coupled to and sensing a voltage of the  
bootstrap capacitor, the controller selectively recharging the bootstrap capacitor as  
a function of the sensed bootstrap capacitor voltage.
2. The switching power supply as specified in Claim 1 further comprising the  
10 controller selectively controlling the low side device as a function of the sensed  
bootstrap capacitor voltage.
3. The switching power supply as specified in Claim 2 wherein the low side  
device is a FET.
4. The switching power supply as specified in Claim 2 wherein the low side  
15 device is a bipolar device.
5. The switching power supply as specified in Claim 1, wherein the  
controller comprises a comparator.
6. The switching power supply as specified in Claim 5 wherein the  
comparator compares the bootstrap capacitor voltage to a reference voltage.
- 20 7. The switching power supply as specified in Claim 2 further comprising a  
gate driver controllably driving the high side FET as a function of the controller.

8. The switching power supply as specified in Claim 7 wherein the controller also couples a charged side of the bootstrap capacitor to the high side FET gate when driving the high side FET.
9. The switching power supply as specified in Claim 8 wherein the controller  
5 couples the non-charging side of the bootstrap capacitor to ground during charging of the bootstrap capacitor.
10. The switching power supply as specified in Claim 8 further comprising a switch selectively coupling the input to the charging side of the bootstrap capacitor during a charging cycle.
- 10 11. The switching power supply as specified in Claim 7 wherein the low side device is enabled anti-phase with the highside FET.
12. The switching power supply as specified in Claim 11 wherein the low side device is a FET.
13. The switching power supply as specified in Claim 11 wherein the  
15 controller also controllably drives the high side FET as a function of a voltage at the output.
14. The switching power supply as specified in Claim 1 wherein an input to output ratio of the switching power supply is at least 95%.
15. The switching power supply as specified in Claim 14 wherein ratio is at  
20 least 97%.
16. The switching power supply as specified in Claim 15 wherein the ratio is about 99%.

17. The switching power supply as specified in Claim 1 wherein the bootstrap capacitor is selectively recharged when the bootstrap capacitor become less effective due to a high duty cycle of the switching power supply.
18. A method of operating a buck regulator switching power supply,  
5 comprising the steps of:
- sensing a voltage of a bootstrap capacitor; and
- selectively recharging the bootstrap capacitor as a function of the sensed bootstrap capacitor voltage.
19. The method as specified in Claim 18 wherein the switching power supply  
10 has a high side FET and a low side device, wherein the low side device is enabled to selectively recharge the bootstrap capacitor as a function of the sensed bootstrap capacitor voltage.
20. The method as specified in Claim 19 wherein the low side device is enabled to selectively recharge the bootstrap capacitor when the bootstrap  
15 capacitor becomes discharged and hence less effective due to a high duty cycle of the switching power supply.
21. The method as specified in Claim 20 wherein the switching power supply has an input to output ratio of greater than 95%.
22. The method as specified in Claim 21 wherein the switching power supply  
20 ratio is greater than 97%.
23. The method as specified in Claim 22 wherein the switching power supply ratio is approximately 99%.